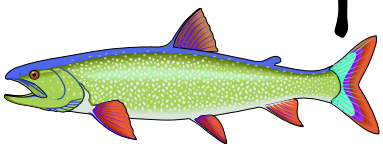
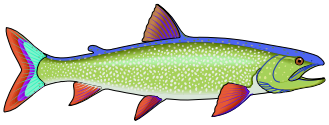
Aquaculture in Utah





January 2006

Newsletter on Current Trends in Aquaculture

Utah Department of Agriculture and Food . Division of Animal Industry
350 N. Redwood Rd., Box 146500, SLC, UT 84114 (801) 538-7029
www.ag.utah.gov

AGRICULTURE MEDIATION BILL SIGNED INTO LAW

Larry Lewis, Public Affairs Officer for the Utah Department of Agriculture and Food, reports that Utah farmers and ranchers who rely on the Certified State Agriculture Mediation Program to help them through difficult economic times will have that valuable service made available to them now that President Bush has signed the Agriculture Mediation Bill. "This is good news for Utah farmers and ranchers who find themselves in financial troubles or involved in adverse decisions regarding USDA programs and need this important service to remain viable," said the Deputy Commissioner of the Utah Department of Agriculture and Food, Kyle Stephens.

The program helps farmers and ranchers seek confidential advice and counsel to address loan problems and disputes before they grow to be too much for the producer to handle. This legislation will authorize funding of the Certified State Agriculture Mediation Program for five years.

Mediation provides a neutral, confidential forum to discuss complex issues and build strong working relationships with producers, their leaders and government agencies. The programs address issues in a confidential and non-adversarial setting outside the traditional legal process of foreclosure, bankruptcy, appeals and litigation.

(See BILL on page 2)

FISH FEED FORMULATIONS

Author: Richard Nelson, VP of Purchasing & General Administration of Silver Cup Fish Feeds, has been actively engaged in Aquaculture for 32 years.

Twenty years ago one could count on one hand the types of fish commercially produced in U S aquaculture: trout, salmon, catfish and shrimp. In Utah the relevant species was (and is) trout. But, elsewhere in the USA, a variety of fish are being produced with success. They include hybrid-striped bass, tilapia, sturgeon, char, black bass, white bass, freshwater shrimp, crawfish, yellow perch, flounder, red drum, cod, cobia and moi (two species grown in offshore, underwater cages, developed to endure the worst of climate conditions, including hurricanes and typhoons).

Decades back the kinds of feeds were equally limited. There was a diet for trout, a diet for salmon, a diet for catfish, etc. And, the feed was all of one type: steam-pelleted, sinking diets.

Today, feed formulations attempt to identify unique characteristics of fish and fish production systems (raceway, tanks, recirculation, net-pens and cages). And it comes down to feed nutrient profiles and the feed pellet's physical characteristics: size, shape, color, stability and buoyancy.

Dietary requirements differ from fish to fish, and even within the

(See FISH FOOD on page 2)

ACQUABIO BIO-REMEDIATION PRODUCTS TREAT POLLUTED WATERS

Author: Kathryn Maldonado, wife of Thomas Maldonado of Acquabio International

Acquabio International is a company that sells a water quality product known as Acquabio-AQ for the remediation of lakes and ponds. Acquabio-AQ is a natural biological treatment system designed for the aquatic industry to control pollution due to excess soluble nutrients, solid wastes, sediments and other organic wastes in the water. It is a live, synergistic blend of all natural class 1 bacteria specifically chosen for their accelerated ability to metabolize organic material and wastes. It has many beneficial uses for polluted ponds.

Acquabio-AQ reduces maintenance in aquatics by utilizing produced wastes as a food source. It reduces the concentration of ammonia, eliminates odors and enhances plankton growth. Acquabio-AQ increases dissolved oxygen in aquatic areas by reducing organic material that causes Biological Oxygen Demand (B.O.D.), such as sludge, and once it is biodegraded, dissolved oxygen levels increase. Once the oxygen demand is reduced, more oxygen will remain in the water and be available to support desired aquatic life. Acquabio-AQ helps eliminate the foul odors associated with the buildup of organic wastes in

(See ACQUABIO on page 4)

(BILL continued from page 1)
Utah farmers and ranchers can contact Utah Department of Agriculture and Food Deputy Commissioner Kyle Stephens to find out more about the program at: (801) 538-7103.

OFF-FLAVOR IN FISH

Off-flavor is the development of undesirable flavors in fish that render them temporarily unmarketable. Fish may have musky, moldy or earthly tastes due to off-flavor. Off-flavor is a critical problem for the catfish industry and other fish industries because it can lead to delayed fish harvests. Harvest delays may cause economic losses, creating an increased risk of loss due to disease problems, loss of sales at processing plants, reduced feed efficiency, and delays in stocking.

The most common off-flavors in ponds are caused by metabolites produced by blue-green algae. These off-flavors are referred to as "musty"—from 2-methylisoborneol (MIB) and "muddy"--from geosmin. Fish absorb MIB and geosmin from the water almost immediately. Absorption continues as long as MIB and geosmin are in the water. In recirculating systems, it is possibly caused by chemicals found in the nitrifying and heterotrophic bacteria. Both cases are results of high organic load

(See FLAVOR on page 3)

(FISH FOOD continued from page 1)
lifecycle of a species. Coldwater finfish nutrition (salmon, trout, char) requires higher amino acids and fatty acids than warm-water fish (catfish , tilapia). And, the nutrient requirements change within the maturing animal. Nutrient density in trout, for example, is greater in the early life stages of fry and juvenile fish. Even warm-water fish can handle some fairly nutrient-rich formulas in their early life stages.

Trout production for restaurants and supermarkets is looking at maximizing fish growth and quality over the shortest period of time. Therefore, nutrient-dense diets of protein and fat are the essential components to meet this goal. Fats provide energy along with essential dietary lipids for health, thus sparing the protein for building muscle-tissue and maintenance.

The advent of feed-extrusion in the 90s, which is different than steam-pelleting, improved the bio-availability of nutrients, thus reducing waste.
Bio-availability of specific ingredients, such as fish meal, has also improved over the years as a result of greater attention to quality parameters in processing. Fish meal, an excellent nutrient in aquaculture programs, has a protein level of 65-70%, of which digestibility is 92-95%! Very few feedstuffs can boast such a claim.

Extrusion allows for greater variability in manipulating physical characteristics of feed, too. Feed can be made to float, sink or sink-slowly in order to meet the limitations of the fish production system and species of fish. As an example, salmon in coastal net-pens require a pellet that will neither sink too quickly nor float on top; as both of these features will likely result in some feeds not consumed by the fish before they've exited the containment pen. In salmon farming, there are even underwater cameras employed at sites to monitor fish behavior so that feeding can be stopped before the fish show signs of satiation and feed gets wasted. It's an environmental and economic imperative.

Extrusion has also reduced dust to a negligible level. Think of the empty breakfast cereal box scenario. That's something to be avoided! Since fish live and breath in their water-environment, it's extremely important to avoid environmental impacts on water quality contributed by feed. Breathing dust in the water column is not desirable for fish.

A balance exists between mutually compatible elements of a fish production matrix: rate of growth, optimum health and disease prevention, production capacity of a system, metabolic waste management, and economics. Favoring one segment to the exclusion of the others can have detrimental consequences. Almost all fish producers, whether they are private or governmental, know clearly how these elements interact and become interdependent. As feeds contribute to many aspects of the matrix and can account for 50% of total production costs in many aquatic production scenarios, it's important to understand how feeds can be "managed" to create optimal balance.

For a free copy of "A Manual for Trout Production", contact Nelson & Sons, Inc. at chris@silvercup.com or request the same through the Utah Dept. of Agriculture and Food, Fish Health Program.

AQUATIC NUISANCE SPECIES UPDATE

Recently the New Zealand Mud Snail (NZMS) was confirmed and reported at the Black Canyon Trout Farm in Grace, Idaho. A phone interview with George Kimball (hatchery owner) revealed that he had recently treated his hatchery for the NZMS. He also reported that the NZMS had only been identified in his lowest of the three raceways and that trout had never been shipped into Utah from that raceway. The UDAF will be carefully monitoring the situation at Black Canyon to ensure the NZMS is not brought into the state.

The NZMS was first reported by Dr. Mark Vinson of Utah State University in Utah in the Green River in September 2001. Since that time, through a recent study done by Dr. Mark Vinson, it has been found in other locations in Utah. Information was obtained from a final report distributed to the Utah Division of Wildlife Resources entitled the Occurrence and Distribution of the New Zealand Mud Snail in Utah by Dr. Vinson. Between 2001 and 2004 a total of 477 locations were sampled for the NZMS in Utah and the snails were found in 28 locations within 16 stream basins. In 2001, the snails were found in only three basins and in eight in 2002. Among those basins found to currently harbor these snails are the Green, Bear, Weber, Ogden, Provo and Logan.

In an effort to keep the NZMS and the zebra mussel from entering into Utah the Fish Health Program requires a signed notice to accompany each shipment of fish into Utah. This Notice of Distribution Statement from the

(See NUISANCE on page 4)

(FLAVOR continued from page 2)
resulting from feeding rates.

Purging off-flavor from fish does not occur until the water is free of MIB and geosmin, which may take anywhere from a few days to several weeks. Purging rate is affected by the initial level of MIB and geosmin in the fish, water temperature, and size and fat content of the fish. Previous reports indicate off-flavor is most likely to occur from June through September. Blue-green algae generally do not grow or produce MIB in water temperatures below 60 degrees Fahrenheit.

Producers have several options when trying to purge fish of off-flavor. Two algicides are currently approved for use in catfish ponds: copper sulfate (CuSO4) or other copper-based products, and Diuron. Both are herbicides that have algicidal properties known to reduce MIB and geosmin at low concentrations. These two algicides are used widely by the catfish industry. Probiotics (see enclosed newsletter article) also may be used to help eliminate MIB and geosmin by reducing algae. Using smaller ponds or smaller tanks may increase chances of having some fish "on-flavor."

Some producers also have tried a biological method, using plankton feeding fish in their ponds to reduce algae. Bleeding live fish before processing will also reduce off-flavors. Some do nothing, knowing that blooms of blue-green algae are sporadic and eventually disappear. Some move fish to another pond with fresh, clean water for several days prior to harvest. Moving off-flavor fish to clean water is usually the most dependable way of improving flavor quality. Currently, chemically treating ponds is the most widely practiced method for prevention and control of algae associated with off-flavor.

In conclusion. A great deal remains to be learned about off-flavor origins, but the most common of these (blue-green algae) may be treatable if conditions warrant. Applications of herbicides (such as copper sulfate) can be expected to have the desired effect only if the off-flavor is due to the ongoing presence of MIB producing algae. The MIB-producing organism (*Oscillatoria chalybea)* is a seasonally occurring alga that may or may not also be present at the same time the off-flavor is detected. Other off-flavor compounds, other than MIB, may be present and undetected until purging the fish is attempted. Purging may or may not be successful, depending on the presence of other compounds, and remembering that fish purge slowly at lower water temperatures. A number of the off-flavor fish placed in clean water at ambient temperatures for a few days will be the most reliable predictor of expected outcomes before entire ponds are subjected to any treatment.

<u>*Article sources:*</u>

Publication 2001, Extension Service of Mississippi State University, cooperating with the U.S. Department of Agriculture. March 2004

Publication 416.1103, Aphis Info Sheet Centers for Epidemiology and Animal Health, USDA. November 2003

(ACQUABIO continued from page 1)
aquatic farming. It reduces algae (dead algae are contributors to oxygen depletion and the source of odor) by out competing the algae and other harmful bacteria for available nutrients and food sources.

Acquabio-AQ oxidizes ammonia and contains bacteria that digest proteins, lipids and detergents in water. In summary, Acquabio-AQ reduces ammonia, biodegrades sludge, eliminates odors, increases dissolved oxygen, enhances plankton and reduces disease causing organisms in affected lakes and ponds.

The owner of Acquabio International, Inc. is Thomas Maldonado. He may be contacted by phone at (520) 584-0480 or (520) 270-1271. His email address is maldota@msn.com and the company address is 7272 East Broadway #245, Tucson, Arizona 85710. Other providers of probiotics may be checked by surfing for bioremediation or probiotics on the web.
Note: UDAF does not endorse this or any particular product. The use of probiotics is a superb way of clearing your water and retarding excessive algae growth. One application at spring time is

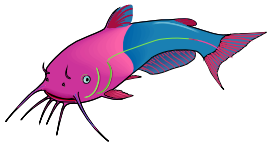
AQUACULTURE RULE REVISED

Recently R58-17, the Aquaculture and Aquatic Animal Health Rule was revised and amended by the Fish Health Policy Board. This rule was adopted September 15, 2005 and is accessible on the Agriculture web site at www.ag.utah.gov under the Fish Health section.

(NUISANCE continued from page 3)
owner of the facility requires a signed signature verifying that the NZMS, the zebra mussel and any other aquatic nuisance species (ANS) are not found within 100 miles of their facility. If so, the name of the watershed and name of the nuisance species which is closest to the facility must be specified. The distance from the identified watershed must also be specified. If the zebra mussel is found within 100 miles of or at the specified facility a signed statement must verify that the proper treatment of the zebra mussel was conducted prior to approval for importation into Utah. Importation will be allowed if the owner documents that the fish to be exported into Utah were reared for all life stages in well water free of the zebra mussel and the fish must be shipped in well water. Prior to approval, all of these requirements are verified by a signature of the owner of the facility.

The Fish health program has pamphlets available to the public regarding aquatic nuisance species and how to prevent their spread. Fish Health also distributes these pamphlets to area merchants that support ANS programs.

Source: NZMS data for this article was obtained from a report to the UDWR written by Dr. Mark Vinson. The report can be located on the web under www.usu.edu/buglab/projects/nzms.htm.



STOCKING FISH IN RECREATIONAL PONDS

Deciding on what fish species to stock in your farm pond depends on the pond type (e.g. coldwater or cool-water). Coldwater ponds are usually deeper and temperatures seldom rise above 72 degrees Fahrenheit. In general, if a good portion of your pond stays below 72 degrees Fahrenheit and is over 12 to feet deep, you may either stock trout or cool-water fish. If your pond is warmer or shallower that this, you may not be able to have trout. If your pond is much shallower than 8 feet without continuous flowing of incoming water, you may encounter winterkill during the winter months. In contrast, the surface temperature of cool-water ponds remains above 72 degrees Fahrenheit for considerable periods in the summer. Coldwater ponds are generally stocked with trout, while cool-water ponds may be stocked with largemouth bass and catfish and forage species. Forage species (e.g. bluegill, fathead minnow) are fish cultured as feed for predatory brood fish (e.g. bass, trout).

Temperature differences between transport water and the pond water can result in immediate or delayed fish mortality. If there is a considerable difference (15-20 deg. F) between the transport water and the pond water, take one hour or more to gradually temper the water temperature and acclimate the fish prior to stocking. Care should be taken when moving fish from one source of water to another so that the water temperature difference does not exceed 5 degrees F. If the water temperature is greater than 5 degrees F, slowly add pond water to the fish container so that the temperature change is not greater

(See STOCKING on page 8)

TROUT EGG DISINFECTION AND INCUBATION PERIOD

Fish eggs received from other hatcheries should be disinfected to prevent the spread of disease. Disinfection should be carried out in separate facilities in order to prevent contamination of the hatchery eggs, water, trays, and packing material from the shipping crate.

The iodophor Betadine, can be used to disinfect most fish eggs. Eggs are treated at 100 ppm active ingredient (iodine) for 10 minutes. A 100 ppm of iodine concentration is obtained by adding 2.6 fluid ounces of 0.5% Betadine per gallon of water. Betadine is also available in a 1% iodine solution. In soft water below 35 ppm alkalinity, pH reduction can occur, causing high egg mortality. Sodium bicarbonate may be added as a buffer at 3.7 grams per gallon if soft water is encountered. The eggs should be well rinsed after treatment. An active iodine solution is dark brown in color. Do not treat eggs within 5 days of hatching as premature hatching may result, with increased mortality.

Iodophor egg disinfection (IED) will act to reduce the probability of egg surface pathogen transmission, but does not completely kill all microbes. A number of factors act to reduce the effectiveness of IED such as the presence of the pathogen with the yolk of the egg (inability of iodophor to contact the pathogen), masking effect of organic matter on the egg, improper pH or iodine concentration, or specific resistance characteristics of the pathogen.

Largemouth bass eggs can be treated with acriflavine at 500 to 700 ppm or with Betadine at 100 to 150 ppm for 15 minutes. Acriflavine is a preventative and treatment for the control of Velvet in freshwater fishes. It has a long history of usefulness for the control of fish diseases. It is useful for fish egg disinfection and external protozoan infections. The drug is effective in the control of the bacterial infection columnaris. Acriflavine may also be used as an additive for egg shipment. Roccal and formalin are not effective disinfectants at concentrations that are not injurious to fish eggs.

Several methods have been devised for determining the incubation period of eggs. One method utilizes temperature units. One Daily Temperature Unit (DTU) equals 1 degree Fahrenheit above freezing (32 deg. F.) for a 24-hour period. For example, if the water temperature for the first day of incubation is 56 deg. F, it would contribute 24 DTU (56 deg.-32 deg F). Temperature units required for a given species of fish are not fixed. However, DTU can be used as a guide to estimate the hatching date of a group of eggs at a specific temperature. They will vary with different water temperatures and are affected by fluctuating temperatures. The following table gives the temperature units needed for hatching three species of Salmonids.

NUMBER OF DAYS (NOD) AND DAILY TEMPERATURE UNITS (DTU) REQUIRED FOR TROUT EGGS TO HATCH

	Water Temperature (deg. F.)					
Species	35	40	45	50	55	60
Rainbow Trout						
NOD		---	80	48	31	24
19						
DTU		---	640	624	558	552
532						
Brown Trout						
NOD		156	100	64	41	---
DTU		468	800	832	738	---
Brook Trout						
NOD		144	103	68	44	35
DTU		432	824	884	779	805

Note: Spaces without figures indicate incomplete data rather than a proven inability of eggs to hatch at those temperatures

Source: Most of the information for this article was taken from the book Fish Hatchery Management, USFWS, 6th Edition, 1998. Additional information was referenced from an USFWS Aquatic Handbook article, Volume 3, Section 1, 1995.

FISH SHOULD NOT BE FED PRIOR TO FISH HEALTH INSPECTIONS

When UDAF inspectors cut open a game fish to obtain tissue samples at your hatchery, it is important that food is not in their gastrointestinal tract. Otherwise, there is a greater chance that exposing the intestine after cutting open the gut or stomach can contaminate the sample and cause a false positive BKD test result. Therefore, we request that you do not feed your fish 48 hours before the fish are sacrificed.

WILD AND FARMED FISH ARE EQUAL IN NUTRITION

The European Food Safety Authority (EFSA) has recently published a report on nutritional values related to the consumption of wild and farmed fish. The report says that there are no consistent differences between wild and farmed fish in terms of nutritional value. More information regarding this study may be obtained at *www.FishUpdate.com* in the July 8, 2005 publication.

Consumption of fish, in particular fatty fish due to their richness in long chain n-3 polyunsaturated fatty acids (omega-3 fatty acids), is beneficial to cardiovascular health. In general, dietary recommendations suggest weekly consumption of one to two portions of fatty fish. Omega-3fatty acids, found primarily in fish oils, are rapidly being confirmed for keeping heart and blood vessels fit. But how much omega-3 fat is enough? The American Heart Association recommends at least two servings of fish per week to get cardiovascular benefits. For example, a three-ounce serving of farmed Atlantic salmon has about 1,500 mg of omega-3 fat. Omega-3 fatty acids are readily available in pill form if fish are unavailable for consumption Standard capsules of 1,000 mg of omega-3 fatty acids can be easily purchased over the counter.

Source: Fish Culture Section of the AFS Newsletter, March & July of 2005.

SEQUENCING TEST CONFIRMED WD POSITIVE TROUT

On July 18, 2005 UDAF collected two rainbow trout from a licensed fee fishing facility in Southern Utah. The trout heads were sent to Microtechnologies (a certified lab in Richmond, Maine) for whirling disease analysis. The heads were processed for *Myxobolus cerebralis* using the pepsin trypsin digest method. These heads were also tested for *M. cerebralis* by PCR.

The individual heads tested negative for *M. cerebralis* by the PTD method but positive by the PCR method, PCR products from one head were submitted by Microtechnologies to the University of Maine for DNA sequencing. To prove that the PCR test was accurate the amplified PCR product was sequenced. In instances when the digest method is negative and the PCR positive, the spore numbers may be low or they may be denatured by the digest process, thus resulting in a negative digest test. Sequencing is becoming more popular in such cases to compare the DNA sequence of the sample with the known sequence. Analysis of the resultant nucleotide sequences by Microtechnologies indicted a "99 % homology of these two trout with known sequences for *M. cerebralis.* Sequence test results substantiated that *M. cerebralis* was present in the sampled trout.

A paper on sequencing was presented at the 9th Annual Whirling Disease Symposium in 2003 by Hogge, Campbell and Johnson. It was entitled "Differentiating the neurotropic *Myxobolus sp.* from *M. cerebralis* and its distribution in Idaho waters." Al

(See WD page 7)

WINDMILLS HELP AERATE LAKES AND PONDS

An aeration system is called for if you have insufficient oxygen in your pond or lake that contains fish. Because adequate amounts of dissolved oxygen are critical for good fish growth and survival, this gas is of major concern to fish growers. Tolerances of fish to low dissolved oxygen concentrations vary among species. Optimal levels for trout are 8 ppm or greater, while warm water species may do well at concentrations above 4 ppm. If oxygen levels become insufficient in your lake or pond, fish may suffer stress and die. Aeration systems also prevent or reduce fish mortality during overwintering.

Two sources of windmills that we inform providers about include Northern Hydraulics of Minnesota (ph 952-238-2080) and Aquatic Eco-Systems of Florida (ph 407-886-3939). As per Aquatic Eco-Systems, a free standing air windmill can effectively aerate up to a one acre pond (15'deep) with as little as a 5 mph wind. Powered by a linear compressor, this diffused air system will add oxygen, create circulation, eliminate dead spots and help keep your fish active and healthy by reducing stress through the addition of dissolved oxygen into your water. As the windmill blade spins, air is generated in the direct drive diaphragm compressor and forced through a narrow airline to a diffuser on the bottom of the pond or lake (up to a maximum of 40' depth).

Windmills from Aquatic Eco-Systems come in a variety of sizes, including standard heights of 12 to 20 feet tall. Sizes of complete systems are available. For example, a small system (at a depth of 4' or

(See WINDMILLS on page 7)

(WD continued from page 6)

though a method accepted broadly in the scientific community, sequencing is not in the latest edition of the Blue Book.

EXTRA-LABEL USE OF MEDICATED FEEDS

The FDA has recognized that some aquatic animals could not be medicated in any practical way other than using medicated feeds. Species such as fish and other aquatic animals have very few drugs approved for their use. The FDA has updated their Compliance Policy Guide (CPG 615.115) to outline the Agency's current thinking on the extra-label use of medicated feeds for minor species. This information may be located at http://www.fda.gov/ora/compliance ref/cpg/cpgvet/cpg615-115.html.

The following information will help interpret this new policy. This interpretation was not prepared by the FDA and is not a statement of FDA Policy. Extra label use is considered to be the treatment of a different species or a different disease not on the drug label. It may involve recommendation of a different withdrawal time other than provided on the label. Extra-label treatment is permissible only under the written or verbal recommendation of a licensed veterinarian with a valid veterinarian-client patient relationship and only when there is a threat to fish health. Using drugs in an extra-label fashion for production purposes is not allowed. If an extra-label use of medicated feed is recommended by a licensed veterinarian the producer must keep complete records of all medicated feeds, including the labels, invoices and dates fed for one year. A copy of the veterinarian's written recommendation must be kept and the treated animals must be identified. The producer must ensure that the withdrawal period recommended by the veterinarian is followed and must comply with all other federal, state or local regulations concerning medicated feed use. In addition, the producer must follow the user safety provisions on the approved drug label and comply with water quality and environmental protection permit requirements.

Only approved drugs for the treatment of specific diseases of specific fish species may be used. For example, no antibiotics are approved for use on tilapia and stripped bass. However, oxytetracycline with the trade name of *Terramycin for Fish* is approved as a "type A" medication for the production of medicated feed for use in salmonids and catfish. It is indicated for control of ulcer disease caused by *Haemophilus piscium,* furunculosis caused by *Aeromonas salmonicida,* bacterial hemorrhagic septicemia caused by *Aeromonas liquefaciens,* and pseudomonas disease in salmonids, and for control of bacterial hemorrhagic septicemia caused by *Aeromonas liquefaciens* and pseudomonas disease in catfish. However, if a tilapia or stripped bass producer establishes a valid veterinarian-client-patient relationship with a licensed veterinarian who diagnoses these diseases in his fish, that veterinarian can provide a written recommendation for the extra label use of a *Terramycin for Fish* medicated catfish or salmonid feed for the treatment of their tilapia or striped bass. Alternatively, if another disease occurs in salmonids or catfish, other than those diseases specified on the *Terramycin for Fish* label, a licensed veterinarian, with a valid veterinarian-client patient relationship, can provide a written recommendation for extra-label use of a medicated feed for that disease. The medicated feed must be delivered as originally formulated for the species and condition according to the approved label and must not be altered.

Utah growers of trout, catfish, or walleye or other locally grown fish may assess their own needs with regard to treatments with approved extra-label antibiotics. In order to receive permission from a veterinarian to use extra-label medicated feeds, a relationship should be previously established with a veterinarian who is familiar with your fish and the situation. Extra-label medications may prove useful in treating diseases of fish when the fish are properly diagnosed and when the medication is properly administered. If your fish are diagnosed with a treatable disease, administration of an extra-label medication may prove effective and may eliminate loss.

Source: Aquaculture and Seafood Advisory Committee ,American Veterinary Medical Association, Schaumburg, Illinois.

(WINDMILLS continued from page 6)

greater) will provide oxygen for up to 100 pounds of fish and circulate water in ponds up to 8,000 gallons. A larger system (at a depth of 4' or greater) can handle up to 200 pounds of fish and circulate water in ponds up to 16,000 gallons. Aquatic Eco-Systems also specifies that windmills are easily installed and are shipped to the fish farmer self equipped. More than one windmill can be added to a pond or lake. Freeze control options are

(See WINDMILLS on page 8)

(STOCKING continued from page 4)

than 2 degrees Fahrenheit per hour. If the water is warmer than the pond water then ice can be added in the tempering process.

Ideally, fish should be stocked when pond water temperatures are equal to hatchery temperatures. Spring and fall are excellent times to stock trout in recreational ponds when water temperatures are below 72 degrees F. Cool-water species, such as largemouth bass, bluegill, and catfish prefer water temperatures ranging from 72-80 degrees F. Bluegill and channel catfish should be stocked in early to mid-fall and largemouth bass the following spring. The reason for stocking the bluegill and channel catfish before the largemouth bass is to give some of these fish an opportunity to grow large enough to escape predation by the bass. The bluegill should spawn the following spring providing forage for the bass. If no bass are present, catfish can be stocked in the spring, summer, or early fall.

Stocking rates vary between species within waters. A standard stocking rate for trout is 400-600 fingerling (5-6 inches long) per surface acre of water. In cool-water ponds a largemouth bass/ bluegill combination is generally recommended. However, fathead minnows can be substituted for the bluegill for an immediate forage fish base and in an effort to keep the pond from being overpopulated with forage fish. A standard stocking rate is 100 bass fingerlings per surface acre along with 500 bluegill fingerlings. Fathead minnows may be stocked at a rate of 300-400 fingerlings per acre. Management practices such as feeding and fertilizing cause the stocking rates to vary (refer to the following table).

Fish Species (Fingerling)	Fed	Not Fed
Bluegill	1000	500
Largemouth Bass	100	50
Channel Catfish	100	50
Rainbow Trout	500	300

*one acre = 43560 square feet (210 feet by 210 feet)

If the pond is at least one surface acre in size, then largemouth bass, bluegill and channel catfish can be stocked. If the pond is less than one acre the best choice may be to stock only channel catfish since in ponds of less than one acre, it is very difficult to maintain the balance between predator (bass) and forage fish (bluegill). In a new pond fingerling size largemouth bass, bluegill and channel catfish (two to three inches) can be stocked. If it becomes necessary to stock fish where a bass population already exists, only larger fish (six to eight inches) or stockers (over eight inches) should be added. Fathead minnows can be stocked at any time since their purpose is to serve as an immediate forage base for predator fish.

Forage fish such as bluegill or fathead minnow should be stocked a year or two prior to stocking yearling or adult bass. Fingerling bass and bluegill can be stocked at the same time. In time, if an adequate number of bluegill are not removed, they may overpopulate the pond and become stunted. Over harvest of adult bass will tip the balance in favor of bluegills. While bullhead catfish are popular with some anglers, they can overpopulate a pond and become stunted. In addition, they are bottom feeders and their foraging often keeps the water muddy, working to the disadvantage of any bass or other fish that may be present. Bass should not be harvested until they have reproduced successfully, which is usually two years after stocking them as fingerlings. If the bass and larger predatory fish are sufficiently harvested thy need to be replaced.

In summary, paying attention to the type, size and number of fish to be stocked, along with the time of year when they should be stocked can result in a successful recreational fishery.

Sources: Fish Stocking in Recreational Ponds, by Charles Collins and Andrew Mitchell, Aquaculture Magazine, November/December 1996.
Commercial Trout Aquaculture, North Carolina state University Cooperative Extension, Agriculture and Forestry, 11-24-04.
Stocking the Pond, Ohio State University Extension, Bulletin 374-99.

(WINDMILLS continued from page 7)

also available.

Several aquaculture providers in Utah are using windmill aeration systems in their ponds and lakes. For example, Sourdough and Wolf Creek Ranches have experienced success through the addition of a windmill aeration system to one or more of their ponds. In addition to adding dissolved oxygen to the water, windmills generating oxygen also help cool the water during summer months.

Information regarding the purchase of windmill systems may be located on the internet by searching “aeration windmills” or from Aquatic Eco-Systems or Northern Hydraulics. The UDAF does not recommend one manufacturer over another. Aquatic Eco-System prices range from $389.00 for a small pond system and up to $827.00 for a large pond sys-

Unless otherwise noted, articles were prepared by Mark Martin and reviewed by Kent Hauck at 801-538-7029.